

Evaluating Pain Response of Metritic Versus Healthy Cows

Natalia Jurcak¹, Jane Stojkov², Daniel Weary², and Marina von Keyserlingk²

¹*Department of Animal Sciences, The Ohio State University, Columbus*

²*The University of British Columbia Animal Welfare Program, Vancouver, BC, Canada*

Abstract

Metritis is a uterine infection commonly affecting dairy cows around parturition, and little work has been done evaluating the pain associated with this disease. Physiological changes, such as back arching, are indicative of pain, and tissue palpation has been shown to be an effective evaluation of visceral pain. The objective of this study was to evaluate the pain response through rectal palpation in cows diagnosed with metritis as compared to clinically healthy cows through rectal palpation. A systematic health check was performed on postpartum Holstein cows (n= 52) between 3 and 15 d in milk to determine health status. The health check consisted of a passive rectal palpation where the examiner's hand was placed above the area of the uterus in a stand-still position to evaluate the response to visceral pain, followed by a vaginal examination. Vaginal discharge (VD) scoring was used to diagnosis metritic cases by the following scale: no mucus or clear mucus, no odor = 0; cloudy mucus, with some pus or blood, no odor = 1; mucopurulent, foul smell = 2; purulent, foul smell = 3; and putrid = 4. A total of 23 metritic cows (VD \geq 2) occurred, and there were 29 healthy cows used in the study. The back arch was recorded using video recording and computer programing was used to determine back arch area (cm²). Metritic cows on the day of diagnosis had an average VD score of 3.48 versus healthy cows with an average score of 0.86 ($P < 0.0001$). The back arch of metritic cows was higher than healthy cows during the passive rectal palpation (566 cm² vs. 771 cm², $P < 0.01$). As expected, the VD was greater for metritic than healthy cows. It was determined that passive rectal palpation provides an indication of pain associated with metritis.

Introduction

Animals can experience various types of pain, including acute and chronic, somatic and visceral, and pain originating from the nervous system (Molony and Kent, 1997). Pain responses may cause physiological and behavioral changes, and these changes can impact the welfare and productivity of the animal. Visceral pain is characterized by diffuse, non-localized pain of the viscera that can be referred to nearby locations and is associated with motor and autonomic reactions (Cervero and Laird, 1999). Inflammation of the female reproductive tract

can produce visceral pain (Cervero and Laird, 1999), and diseases of these organs have proven to be painful, such as in women with endometritis (Nelson et al., 1998) and mares with pneumovagina (Christoffersen et al., 2007).

Metritis is an infection of the uterus that commonly affects dairy cattle after parturition, characterized by inflammation of the uterine wall (Sheldon et al., 2005). Metritis is associated with lower conception rates and greater culling rates due to failed conceptions (Sheldon et al., 2005), along with lower milk production, lower feed intake, and less competitive behavior at the feed bunk (Huzzey et al., 2007).

Mechanical stimuli, such as tissue palpation, are accepted methods to produce a pain response (Ness and Gebhart, 1990). The objective of this study was to compare the pain response of metritic and healthy cows. We predicted that cows diagnosed with metritis would show a greater back arch when compared to the back arch of healthy cows in response to a passive rectal palpation.

Materials and Methods

After parturition, cows were subjected to systematic health checks starting 3 d after parturition and continuing every 3 d for 18 d. The health check consisted of a passive rectal palpation (PRP) and vaginal examination. According to the VD the cow health status was determined using the scoring of Huzzey et al. (2007): no mucus or clear mucus, no odor = 0; cloudy mucus, with some pus or blood, no odor = 1; mucopurulent (less than 50% pus), foul smell = 2; purulent (more than 50% pus), foul smell = 3; and putrid (red/brown color, watery, foul smell) = 4. Healthy cows (n=29) were given scores 0-1; metritic cows (n=23) received scores 2-4.

Passive rectal palpation

The purpose of the PRP was to induce the back arching response by palpating the rectum (near the uterus), which should be in a state of hyperalgesia due to the inflammation of the uterus. The PRP would increase the mild visceral pain that we suspect is present in cows with metritis. Before the PRP starts, the examiner placed 2 wax body marks: mark A on the highest thoracic vertebrae (shoulder region) and mark B on the first coccygeal vertebrae; and video recorded a 1 min baseline. During the PRP, the examiner proceeded with the following steps:

1. Enter the rectal cavity and evacuated the feces (30 to 40 sec),
2. A one minute break was allowed for the cow back arch to return to normal (Figure 1 A)

3. Entered the rectal cavity; with the needed arm length to enable the hand to rest above the location of the uterus and keep the arm in a stand-still position for 20 sec. (Figure 1 B)

Video recording

During the PRP, a side view camera was used to record the body posture, particularly the back arch. The video recording should include the entire body of the cow, including the entire length of the feet. It was positioned perpendicular to the cow's body 3 m away from the cow and at a height of 1.45 m and an inclination (tilt) of approximately 10° (keeping 1 m distance from the headlocks).

Snapshot selection

The back arch was assessed during PRP using 4 snapshots at the 4, 8, 12, and 16 s from the onset of this phase. These four values were averaged to determine the total area of back arch (cm²) observed during the PRP. The back arch was defined as the shape created by connecting a straight line (C) from the thoracic (A) to coccygeal (B) vertebrae designated by the wax marks (Figure 2). A second line (D) outlined the curve of the spine to connect the two points. This area was selected and measured using Adobe Photoshop CS6 (Adobe Systems, San Jose, CA, USA) to determine a pixel count which was then converted to cm².

Data Analysis

The VD and back arch data were analyzed as a completely randomized design using the general linear model procedure of SAS (SAS Institute, Inc., Cary, NC). Significance was declared at $P < 0.05$ and trends at $0.05 > P < 0.10$.

Results and Discussion

Cows diagnosed with metritis had a greater VD score than healthy cows (3.48 vs. 0.86, $P < 0.01$) (Figure 3). Metritic cows also displayed a greater back arch than healthy cows when rectally palpated (566 cm² vs. 771 cm², $P < 0.01$) (Figure 4).

The abnormal enlargement of the uterine wall in response to increased leukocyte infiltration and inflammation characterize metritic infections (Sheldon, et al., 2005) may cause visceral stimulation and induce a pain reaction (Cervero and Laird, 1999). Fetid discharge is

also a characterizing sign of metritis (Sheldon, et al., 2005), and the higher VD scores attributed to the metritic cows suggest that these cows are experiencing an infection and the pain associated with accompanying inflammation. Cows with metritis also had greater responses to rectal palpation. The more pronounced back arch of metritic cows is likely associated with the inflammation as studies have shown women with uterine inflammation and abdominal pain had greater tenderness in the areas of the cervix, uterus, and abdomen (Nelson et al., 1998).

Cattle are known to induce a back arch under both physiological and pathological conditions. Defecation, urination, and the birthing process all induce a physiological back arch in cows, and the discomfort of vaginal examinations also cause the back arching reflex in cattle (Mainau and Manteca, 2011; Pilz et al., 2012). This reflex is also seen in cases of lameness and hoof lesions, and a study by Flower and Weary (2006) used back arch severity as a factor in lameness assessment. The results of this study suggest the use of back arching for the assessment of metritis and pain experienced by cattle in the reproductive tract and nearby areas.

Due to the ability for visceral pain to be diffuse and the close proximity of the uterine and rectal wall (Cervero and Laird, 1999), the back arch reflex seen in metritic cows suggests the rectum was in a state of hyperalgesia. The stimulation of the rectal palpation, although similar to the back arch response of defecation, caused more of a reaction in metritic cows. The assumption of visceral pain spreading to the rectum would account for such differences seen in healthy and metritic cows with an inflamed uterus. Studies have documented the occurrence of hyperalgesia of abdominal and rectal areas in mares, rats, and women due to reproductive diseases and menstrual pain (Brinkert et al., 2007; Christoffersen et al., 2007).

Conclusion

The VD score of a cow may be useful in determining metritis, with a higher score indicating possible visceral pain. A passive rectal palpation can be used to determine the visceral pain associated with metritis by assessing the back arch of dairy cattle. Metritic cows are in a higher state of visceral pain when palpated than healthy cows. Cows diagnosed with metritis may benefit from treatment to reduce the pain associated with the disease.



Figure 1A. Baseline back arch, resting phase

Figure 1B. Induced back arch, passive rectal palpation



Figure 2. Visual representation of how back arch area was determined during passive rectal palpation.

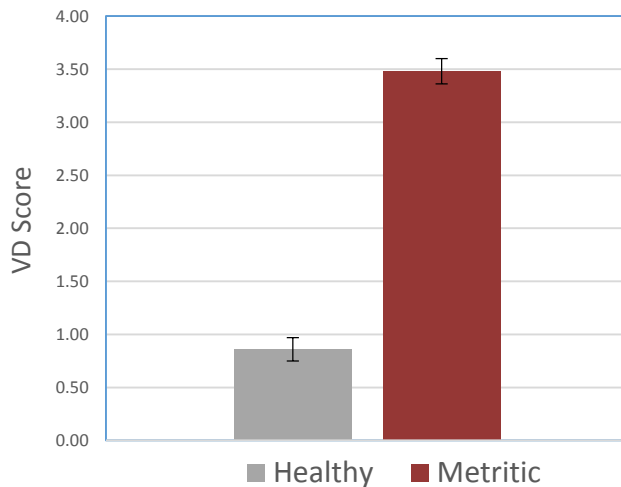


Figure 3. Vaginal discharge (VD) score for healthy and metritic cows.

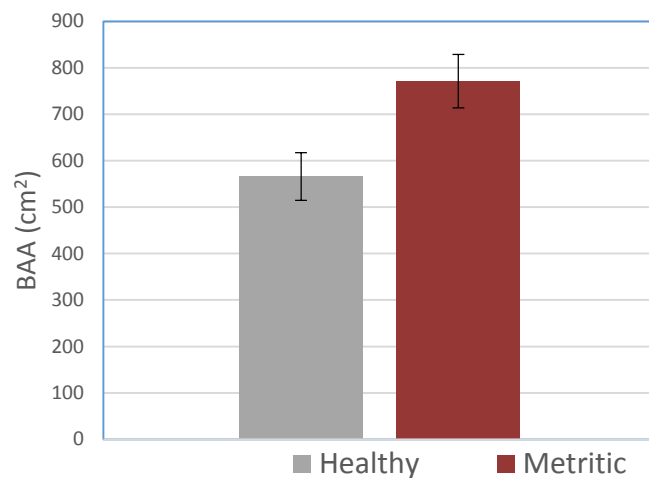


Figure 4. Back arch area (BAA) for healthy and metritic cows.

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